

The Accumulative Effect of Trauma Exposure on Short-Term and Delayed Verbal Memory in a Treatment-Seeking Sample of Female Rape Victims

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The accumulative effect of prior high-magnitude trauma exposure on memory was examined in 73 rape victims, 92% of whom had current posttraumatic stress disorder (PTSD). Participants were administered the Logical Memory component of the Wechsler Memory Scale, the Quick Test to obtain an estimate of intelligence, and were assessed for prior traumatic experiences. Prior exposure to high-magnitude stressors (e.g., child rape, being kidnapped) was significantly correlated with poorer performance on the memory tasks. Regression analyses controlling for estimated IQ and psychopathology severity demonstrated that magnitude of prior trauma exposure predicted performance on the memory task, suggesting that in the current sample, deficits in verbal memory may be related (in part) to the degree of accumulative stress experienced over the lifetime.

KEY WORDS: rape; PTSD; memory; trauma; neuropsychology.

The influence of trauma exposure and specifically posttraumatic stress disorder (PTSD) on memory functioning has attracted increasing attention in the literature in recent years. Research with both the animals and humans has suggested a link between extreme and/or chronic stress and impaired memory performance, believed to occur through the release of the stress hormone cortisone that can have a deleterious effect on the hippocampus (Bremner et al., 1993; De Bellis, 2001). Investigations with PTSD samples have often demonstrated deficits in neuropsychological performance although at times these findings have been mixed (see Golier & Yehuda, 2002, for review). A relatively consistent finding has been impaired performance on verbal learning as well as short-term and delayed recall memory tasks in civilian (Jenkins, Langlais, Delis, & Cohen, 1998), combat (Vasterling et al.,

2002), and Holocaust survivor samples with PTSD (Golier et al., 2002). However not all studies have found such deficits (e.g., Koenen et al., 2001; Stein, Hanna, Vaerum, & Koverola, 1999; Stein, Kennedy, & Twamley, 2002).

When reviewing the neuropsychological literature in PTSD, it is of note that prior trauma history, a potential confound, is rarely taken into account. As research has suggested a relationship between extreme stress and impaired memory performance, it is plausible that more severe trauma exposure, whether it be through multiple trauma exposures or high magnitude stressors, could be related to poorer performance on neuropsychological tasks, thus explaining some of the discrepant findings in the literature. However most of the studies reviewed failed to control for level of traumatic exposure, and in the case of studies of adult trauma, did not control for history of traumatic exposure prior to the index event of interest.

The present study was undertaken as a preliminary attempt to delineate the degree to which prior traumatic exposure influenced short-term and delayed verbal memory in a sample of adult rape victims, the majority of whom had PTSD. Prior traumatic exposure in both childhood

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and adulthood, and potentially confounding variables such as substance dependence and comorbid psychopathology was documented. We hypothesized that the magnitude of prior trauma exposure would predict poorer performance on verbal memory tasks.

Method

Participants

Participants were treatment seekers for rape-related PTSD involved in a larger study (see Resick, Nishith, Weaver, Astin, & Feuer, 2002). Participants were excluded if they met current criteria for substance abuse/dependence, had a history of head injury associated with loss of consciousness or neurological impairment or psychosis. Participant characteristics were as follows: mean age of 32.29 years ($SD = 9.69$), average length of education was 14.60 years ($SD = 2.82$), 67 met full criteria for current PTSD, 6 participants were subthreshold PTSD (one symptom short), 42 had current Major Depressive Disorder (MDD), and 18% were taking some form of psychotropic medication. In terms of past substance dependence, 39% of the sample met criteria for alcohol dependence, 22% for other drug dependence, and 1% for polysubstance dependence.

Measures

Structured Clinical Interviews

The Clinician-Administered PTSD Scale (CAPS; Blake et al., 1995) was used to assess PTSD. MDD and alcohol and substance dependence was assessed using the Structured Clinical Interview for DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 1996).

Trauma Interview

The frequency of childhood trauma exposure was assessed with items from the Sexual Abuse Exposure Questionnaire (SAEQ; Rowan, Foy, Rodriguez, & Ryan, 1994), and the Assessing Environments-III—Physical Punishment Scale (AE-III-PP; Berger, Knutson, Mehm, & Perkins, 1988). The SAEQ measured behaviors ranging from sexual fondling to penetrative sex (on a 0–6 scale, where 0 = *never* and 6 = *more than once a week*) and the AE-III-PP measured discipline events (dichotomously) such as being locked in the closet and being hit with objects, with the number of affirmative responses summed

to create a total score. The frequency of adulthood victimization experiences (e.g., being a victim of a robbery, assault, attempted sexual assault, etc) was determined using a scale ranging from 0 to 5 (0 = *never*, 5 = *21 or more times*).

Alcohol Use

Interview questions were used to determine how many days of the past month participants had consumed alcohol and the number of standard alcoholic drinks consumed, as well as the number of years they had used alcohol, and the longest period of abstinence (in years).

Memory and Intelligence Tests

The Quick Test (QT; Ammons & Ammons, 1962) is a 50-item test of general intelligence. The estimated IQ score (standardized) is reported in the present study. Logical Memory I (LM-I) and Logical Memory II (LM-II; 30-min delay) from the Wechsler Memory Scale—Revised (WMS-R; Wechsler, 1987) were used as tests of verbal memory. Raw scores (unweighted) were used rather than scaled scores to ensure fine-tuned measurement. All tests were administered by experienced graduate-level research assistants trained by the second author.

Self-Report Questionnaires

Participants completed the following established self-report instruments: the PTSD Symptom Scale (PSS; Foa, Riggs, Dancu, & Rothbaum, 1993), and the Beck Depression Inventory (BDI; Beck, Ward, Mendelsohn, Mock, & Erbaugh, 1961).

Results

Preliminary correlational analyses revealed a significant relationship between memory performance and frequency of high-impact stressors: being kidnapped as an adult, prior rape as an adult, and attempted murder as an adult, thus these scales were summed to provide a single measure of the frequency of high-impact trauma exposure (see Table 1). Because of nonnormal distributions, the occurrence/nonoccurrence of childhood rape (penetrative intercourse) was recoded dichotomously, and was also significantly correlated with memory performance. Performance on Logical Memory was also related to estimated IQ, but not other variables such as age, education, PSS, BDI, use of psychotropic medication, any alcohol

Table 1. Correlations, Means, and Standard Deviations for Predictor Variables and Logical Memory Scores

Predictors and dependent variables	1	2	3	4	5	6	7	<i>M</i>	<i>SD</i>	Range
1. Childhood rape ^a	—							17%	—	—
2. Adulthood trauma	.20	—						1.44	2.33	0–11
3. Estimated IQ	-.29*	-.11	—					100.66	10.43	70–120
4. PSS	.14	.31**	.05	—				28.45	9.06	12–46
5. BDI	.38**	.03	-.08	.45***	—			23.35	9.52	0–49
6. LM-I	-.28*	-.35*	.29*	-.15	-.10	—		25.56	7.00	9–42
7. LM-II	-.23*	-.26*	.20	-.09	-.05	.91***	—	22.38	7.39	3–39

Note. PSS = PTSD Symptom Scale; BDI = Beck Depression Inventory; LM-I = Logical Memory—Immediate Recall; LM-II = Logical Memory—Delayed Recall.

^aCorrelations with dichotomous variables are Spearman rank-order correlations.

* $p < .05$. ** $p < .01$. *** $p < .001$.

or substance use measures, or any other trauma experiences.

Hierarchical regression was used to predict verbal memory performance. As summarized in Table 2, only estimated IQ and prior trauma exposure predicted immediate recall on the Logical Memory task (LM-I), with approximately 27% of variance in scores being accounted for. Only adult trauma exposure was a significant predictor of performance on delayed recall (LM-II), accounting for approximately 20% of the variance in scores (Table 3).

We then compared those who had experienced a prior completed rape as an adult, versus those who had not. Participants who reported a prior adult rape demonstrated poorer performance on both tasks ($n = 32$; LM-I: $M = 23.28$, $SD = 7.46$; LM-II: $M = 20.31$, $SD = 8.11$) than participants who did not report a previous adult rape (LM-I: $M = 27.34$, $SD = 6.15$; LM-II: $M = 24.00$, $SD = 6.41$). This difference was significant, $t(71) = 2.55$ and $t(71) = 2.17$, respectively, $p < .05$, and Cohen d effect sizes between the groups were 0.60 (LM-I) and 0.51 (LM-II). There were no differences between the two groups in terms of estimated IQ or symptom severity (PSS, BDI). The same pattern of findings was observed when the sam-

ple was stratified into those who had experienced child rape versus those who had not. Participants who reported a child rape performed worse on both tasks ($n = 12$; LM-I: $M = 20.36$, $SD = 5.71$; LM-II: $M = 18.18$, $SD = 6.01$) than participants who did not report child rape (LM-I: $M = 26.93$, $SD = 6.81$; LM-II: $M = 23.55$, $SD = 7.58$). Because the child rape group had significantly lower BDI scores ($p < .01$) and a trend for lower estimated IQ ($p = .07$), this was controlled in the analysis. The difference on both LM-I and LM-II was significant, $F(1, 63) = 7.29$, $p < .01$ and $F(1, 63) = 4.35$, $p < .05$, respectively, and the effect sizes of 1.05 (LM-I) and 0.79 (LM-II) were sizable.

Discussion

The present findings show that in this sample of adult rape victims, performance on a short-term and delayed verbal memory was strongly associated with the degree of prior traumatic experience rather than PTSD or depressive symptomatology. Prior trauma uniquely accounted for 15–17% of the variance in memory scores after controlling

Table 2. Summary of Hierarchical Regression Analysis of Logical Memory Scores (Immediate Recall): Estimated IQ, PSS, BDI, and Prior Trauma Exposure as Predictor Variables

Predictors	<i>B</i>	<i>SE B</i>	β	ΔR^2	Adjusted R^2	Multiple <i>R</i>	Overall <i>F</i>
Step 1							
Estimated IQ	0.20	0.09	.28*	.08	.06	.28	$F(1, 65) = 5.30^*$
Step 2							
PSS	-.015	0.10	-.19				
BDI	0.07	0.10	.10	.03	.06	.32	$F(3, 63) = 2.44$
Step 3							
Childhood rape	-6.41	2.32	-.34**	.10	.15	.45	$F(4, 62) = 3.93^{**}$
Step 4							
Adult trauma	-0.86	0.37	-.29*	.07	.21	.52	$F(5, 61) = 4.47^{**}$

Note. PSS = PTSD Symptom Scale; BDI = Beck Depression Inventory.

* $p < .05$. ** $p < .01$.

Table 3. Summary of Hierarchical Regression Analysis of Logical Memory Scores (Delayed Recall): Estimated IQ, PSS, BDI, and Prior Trauma Exposure as Predictor Variables

Predictors	<i>B</i>	<i>SE B</i>	β	ΔR^2	Adjusted R^2	Multiple <i>R</i>	Overall <i>F</i>
Step 1							
Estimated IQ	0.14	0.10	.18	.03	.02	.03	$F(1, 65) = 2.08$
Step 2							
PSS	0.09	0.12	-.11				
BDI	0.06	0.12	.08	.01	-.00	.04	$F(3, 63) < 1$
Step 3							
Childhood rape	-5.55	2.65	-.27*	.06	.05	.11	$F(4, 62) = 1.82$
Step 4							
Adult trauma	-1.10	0.41	-.34*	.09	.13	.20	$F(5, 61) = 3.03^*$

Note. PSS = PTSD Symptom Scale; BDI = Beck Depression Inventory.

* $p < .05$.

for estimated IQ and psychopathology symptom scores. Thus prior traumatic events appear to still exert an influence on memory performance, suggesting there may be an association between the accumulative effect of trauma exposure and verbal memory functioning. This statement should be qualified with the knowledge that prior trauma could exert its effects in multiple ways, and the possibility that previous PTSD due to prior trauma contributed to the observed deficits cannot be excluded. Because memory performance was not related to other potentially confounding variables such as age, education, level of alcohol use or past substance dependence, and participants had been screened for neurological insults, we believe further investigation of the effects of accumulative trauma experiences and memory functioning is warranted.

We recognize the limitations of the present study. First, the lack of a trauma-exposed, non-PTSD comparison condition prevents investigation of the separate influence of level of traumatic exposure and PTSD symptomatology on memory. Related to this issue is the potential for ceiling effects in psychopathology scores because the sample comprised PTSD and subthreshold PTSD participants, which could then have influenced the regression findings. Although this is a possibility, examination of this data (e.g., Table 1) suggests that this was not a significant issue. Second, the results should be interpreted with the knowledge that impaired performance on the Logical Memory task can occur for a variety of reasons, and cannot be localized to a specific brain region. Third, because our interpretations are based upon findings on a single measure, replication is necessary, preferably with several neuropsychological tests. More fine-tuned analysis of prior trauma *severity* (vs. frequency), and more sensitive measurement of alcohol use would also strengthen future studies of this type. These limitations aside, the present study has demonstrated the importance of taking into account different types of prior traumatic events when investigating memory disturbance in chronic PTSD. Sim-

ilar studies in the future will further our understanding of the complex relationship between traumatic stress and neuropsychological functioning.

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